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ABSTRACT

Based on the view that young children have a different intellectual culture from adults' in the way they know and understand nature, this paper explores ecological human brain development, children's intellectual culture of naturalist intelligence, and developmentally and culturally congruent curricula for young children. The paper discusses the theoretical connection between developmentally and culturally appropriate practice (DCAP) and the ecological human brain. Gardner's view of naturalist intelligence is presented as the ability to recognize and classify plants, minerals, and animals needed to survive. The paper argues that across all cultures, children have a unique affinity for the natural environment different from that of adults and that adults often respond in intellectually incongruent ways to children's knowledge constructions about nature. The paper contends that failing to support children's knowledge construction about nature during critical periods can have serious implications for how children will relate to the natural world over their lifespan. The paper describes the ecological brain as dependent on social-cultural input and as constantly changing structure and function in response to external experiences. The paper also describes the DCAP base curriculum as an exploratory curriculum that responds to, validates, and reinforces children's naturalist intelligence. The paper concludes by asserting that responses to children's naturalist intelligence should be based on their curiosity-center intellectual culture and reflected in daily exploratory curriculum. (Contains 44 references.) (KB)

# Ecological Human Brain and Young Children's "Naturalist Intelligence" from the Perspective of Developmentally and Culturally Appropriate Practice (DCAP)



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# Ecological Human Brain and Young Children's "Naturalist Intelligence" from the Perspective of Developmentally and Culturally Appropriate Practice (DCAP)

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## Abstract

According to human brain development (e.g., Diamond & Hopson, 1998; Shore1997),"naturalist intelligence"(Gardner 1999; 1997) and the notion of children's nature given wondrous mind (Wilson,1984; Wilson,1997), there is *a different intellectual culture* in young children's way of knowing, understanding nature, constructing knowledge and using of it that are different from adults. *How is young children's intellectual culture of understanding nature different from adults? What should be considered in developmentally and culturally appropriate curriculum for young children?* This paper is to explore "ecological human brain" development, children's intellectual culture of "naturalist intelligence," and developmentally and culturally congruent curriculum consideration for young children. (101 words)

## Backgrounds and Scope

Developmentally and culturally appropriate practice (DCAP) is a metacognitive framework that is designed for early childhood teachers to think and act more critically, ethically, and reflectively about their developmentally appropriate practice (DAP) (Bredekamp & Copple, 1997) in order to bring culturally congruent teaching and learning environments for ALL young children. DCAP framework promotes teachers to ponder about other-possible-best-approaches that would be congruent to the individual child's growth for her/his own fullest potential. The framework suggests teachers become multiple/multiethnic perspective-takers in their process of decision making as reflective teachers (Hyun, 1998; Hyun, 1996; Hyun & Marshall, 1997; Hyun & Marshall, 1996). DCAP[1] is pertinent to ALL young children who are:

First, experiencing multidirectional developmental growth and change;

Second, constructing unique way of knowing and one's own intelligences based on the way they perceive the world of nature within the cultures they encounter that are different from adults as well as each other;

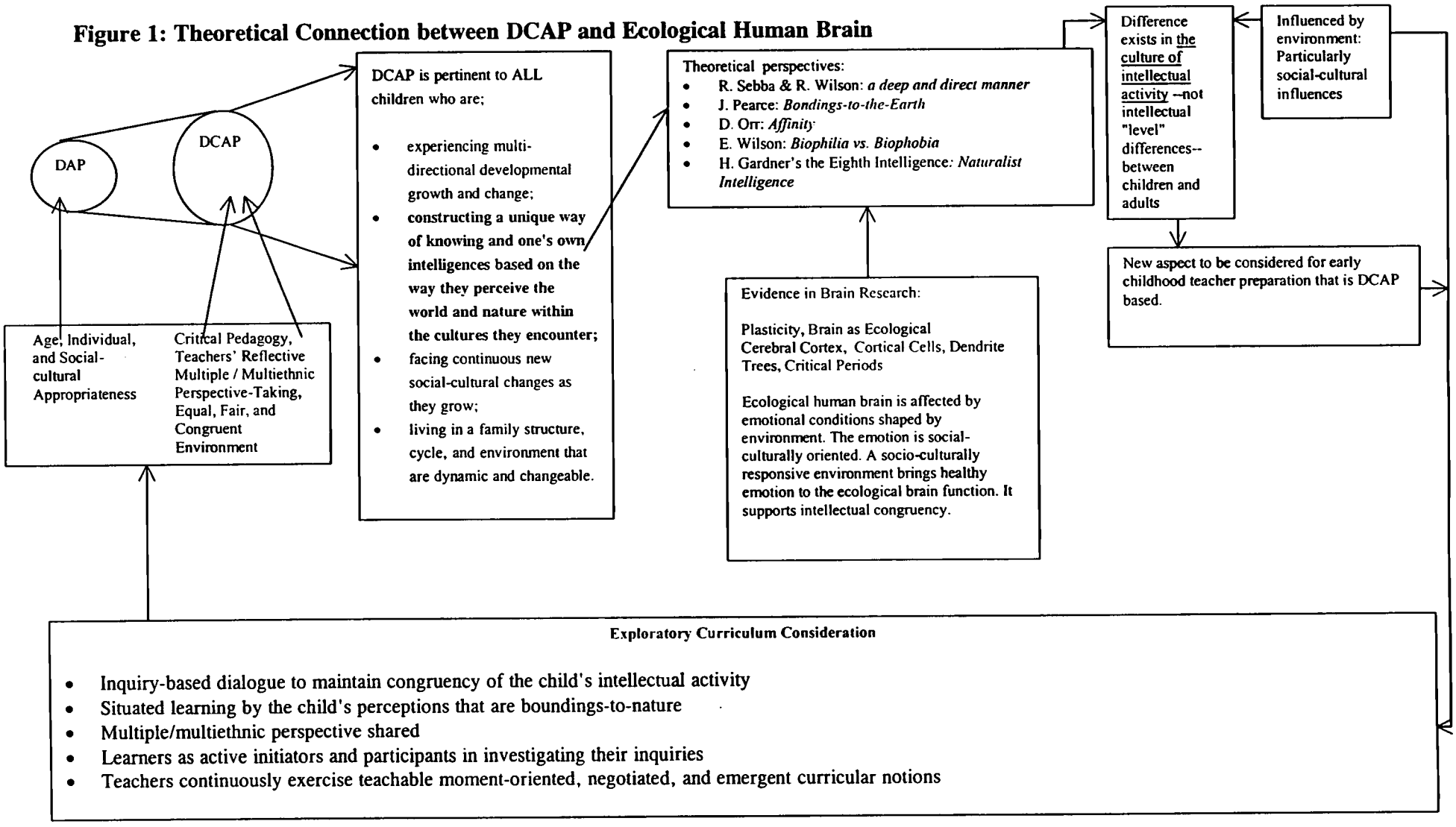
Third, facing continuous and new social-cultural changes as they grow; and

Last, living in a family structure, cycle, and environment that are dynamic and changeable.

This particular article discusses the second pertinence: young children's intellectual culture (not intellectual/cognitive "level") that is different from adults' in understanding nature.

According to Diamond and Hopson's (1998) and Shore's (1997) discussion on human brain development, Gardner's (1999) the eighth intelligence: "naturalist intelligence," and E. O. Wilson's (1984) and R. Wilson's (1997) notion of children's nature given wondrous mind, it is clear to articulate that there is *a different intellectual culture* in young children's way of knowing, understanding nature, constructing knowledge, and using of it. It is important to add this aspect to the early childhood teacher preparation for DCAP, since DCAP aims at preparing teachers who are able to create and promote not only developmentally but also *culturally congruent* teaching and learning environments for ALL *individual* children. This theoretical article discusses the importance of understanding young children's intellectual culture of naturalist intelligence and thus, curriculum consideration in the perspective of DCAP. Figure 1 briefly oversees the discussion (see Figure 1).

## Figure 1: Theoretical Connection between DCAP and Ecological Human Brain



## The Nature Given Naturalist Intelligence

Based on human brain researches (e.g., Caramazza, Hillis, Leek, & Miozzo, 1994; Damasio & Damasio, 1995; Konorski, 1976; Martin, Wiggs, Ungerleider, & Haxby, 1996; Nielson, 1946; Warrington & Shallice, 1984), Gardner articulates that *naturalist intelligence* is a nature given intellectual culture[2] and ability we all have in order to survive as human beings as other animals (e.g., we need to know which animals to hunt and which to run away from for the same purposes of survival) (Checkley, 1997; Gardner, 1999). When Gardner introduces the eighth intelligence--"naturalist intelligence"--he explains;

> The naturalist intelligence refers to the ability to recognize and classify plants, minerals, and animals, including rocks and grass and all variety of flora and fauna. The ability to recognize cultural artifacts like cars or sneakers may also depend on the naturalist intelligence. ...everybody can do this to a certain extent - we can all recognize dogs, cats, trees. But, some people from an early age are extremely good at recognizing and classifying artifacts. For example, we all know kids who, at age 3 or 4, are better at recognizing dinosaurs than most adults. Darwin is probably the most famous example of a naturalist because he saw so deeply into the nature of living things (Interview with Checkley 1997, p.9).

Gardner sees naturalist intelligence as an intelligence all human beings are born with and young children tend to exhibit this particular intelligence more than adults. The reason "why" children exhibit a higher level of naturalist intelligence than adults is, according to Sebba (1991) and Wilson (1997), children experience natural environment in *a deep and direct manner* not as a background for events. (see Table 1.)

**Table 1.** ***A Deep and Direct Manner*** **vs. A Background For Events**

| |
|---|
| *Interviewer: What do you see in this playground garden?*<br>*A 4-year-old girl: I see small rocks--many, many rocks. I see flowers (touching rocks and flowers). They have different colors. I see a butterfly. It has lines and dots--same in the both sides (pointing to the two wings). Later drew a picture of flower and butterfly.*<br>*A 4-year-old boy: I see a big bumblebee buzzing like this (pretends to be a bumblebee and flapping both arms and saying buzzzzzzzz...)!*<br>Later draw a picture of butterfly.<br>Children*: They see pebbles; they play with pebbles; ... they see patterns of the butterfly; they drew the butterfly; they act out bumblebees' buzzing ... The children interact with nature by touching, playing, and pretending as direct manners. |
| *Interviewer: What do you see in the playground garden?*<br>*A preschool teacher: I see trees, soils, benches, some bees, butterflies, flowers, and other* insects. |
| Adults: They see trees, the ground, and benches...they see bees and butterflies on flowers—they don't interact with nature as the 4-year-olds above. |

Source: Field notes; data collected 1994, State College, PA, at a local preschool playground.
Note)* This is an another critical issue relate to young children's gender differences in their development of the naturalist intelligence, which is not discussed in this particular paper. [Hyun, E. (research-in-progress)].

For young children, natural environment is an everlasting and dynamic stimulator, because children perceive the natural world through their primary perceptions, which are based on their sensory-directed experiences. More importantly, these primary perceptions are "bondings-to-the earth," thus interaction with the physical substance of the living earth and the environment is natural, inseparable, and critical to the child's developing brain and intelligence (Pearce, 1977).

## A Different Intellectual Culture Between Children and Adults

Across all ethnic cultures it is clear that children have a special close relationship--affinity-- for the natural environment which is different from adults

(Pearce, 1977; Sebba, 1991; Wilson, 1997). Children have an affinity that is a natural and personal attraction, and is connected to the child's development and his/her unique way of knowing, constructing knowledge, and making sense of the world of nature including the human social world (i.g., Carson, 1956; Nabhan & Trimble, 1994). As Table 1 illustrated earlier, young children's culture of intellectual activity is different from adults. It may be less congruent to adults' intellectual culture.

Early childhood learning experience depends upon concrete perceptual experience and information constructed from the direct experience (e.g., Piaget). In that regard, R. Wilson (1995) and R. Sebba (1991) present that during the early stage of cognitive development, nature-given *perception conducts thought*. In contrast, human adults' intellectural culture of way of knowing is mostly based on *perception obeys thought* (see Table2).

**Table 2. Culture of Discourse That is Intellectually Mismatch**

| *Perception conducts thought (Child)* | *Perception obeys thought (Adult)* |
|---|---|
| *A 3-year old girl looking at a snake: What is this? I see it has no legs. But it moves! I wonder how it moves without legs? (Biophilia)* ◄► | *Father of the girl: Oh, it's a snake! Don't touch it! It may have some poison. It may kill you or hurt you! (Biophobia)* |
| *A 4-year old boy looking at a snake: It's a snake! I want to touch it! It has black shiny scales! (Biophilia)* ◄► | *Father of the boy: Move back! It may be a poisonous one. Let me get a stick. We'd better kill it. It's dangerous to have a snake around this area, because you guys are always playing here. (Biophobia)* |
| *A 5-year old girl looking at ants on the surface of an old concrete wall: Ants! They are carrying food (a small piece of bread)!... How do they live inside of this wall? How do they build their home inside of this hard wall? (Biophilia)* ◄► | *Mother of the girl: These ants make the building get old. They make holes inside of the building or home...We need to spread a bug spray! "The ants killer." (Biophobia)* |
| *A 5-year-old boy looking around a broken red brick which is one of the surrounding bricks of his window, and pointing at the ants carrying cookie crumbs that he had dropped the other day near by the window: How do they carry the big piece of cookie crumb? It is much bigger than its own body size. Cool! Are they like a... "Herculy" on TV? (Biophilia)* ◄► | *A mother of the boy: Close the window! Do not let those ants come inside of your room. I need to call pest control. They (the ants) may chew this old home down. (Biophobia)* |

Source**: field notes, May 1998. Fort Myers, FL (First two discourses), June, 1998, Chicago, IL (Last two discourses)

NOTE**) As described in Table 2, sometimes there is a clear evidence of gender biased cognitive reasoning by the adults' social-culturally oriented mind. This is an another critical issue relate to young children's gender differences in their development of the naturalist intelligence, which is not discussed in this particular paper. There is a clear difference in parental behavior regarding how to respond to young boys and girls interests in nature. More field base social phenomenological research is needed for this particular topic. [Hyun, E. (research-in-progress)]

As illustrated in Table 2, adults open respond in intellectually incongruent ways to young children's knowledge construction about nature. Children are exposed to the

culture of discourse that is intellectually mismatched between their way of knowing and the adults' way of knowing regarding nature.

There is a mental movement that is shifting from the child's culture of intellectual activity, which is concrete perceptual experience-based to the adult's way of knowing the world, which involves a deflection from sensory absorption to social-culturally directed cognitive reasoning. For example, instead of interacting with nature, exploring their curiosities of nature, and caring for nature as child, adults who have already been oriented with a cognitive reasoning tend to think of nature as how-to-use-it for the purpose of human needs and profits, or how-to-stay-away-from-it to avoid an accident. This is an extremely industrious and human ethnocentric cognitive reasoning, which is based on a perceptual culture of adult thoughts.

As many brain researches report, there is a critical period, more accurately described as "sensitive periods" of the affinity. The interaction between the child and the natural environment is an authentic childhood experience across cultures that carries with the original stamp of human biology that will disappear with its passing after the critical early childhood period (Pearce, 1977; Wilson, 1997). Failing to recognize or not supporting children's intellectual culture of constructing knowledge about nature can have serious implications on how children will relate to the natural world over the span of their lifetime. We all have a love of nature, natural attraction, and affinity for life. During early childhood period, this love of nature directly affects the young human minds' culture of intellectual activities and their way of knowing about nature (Orr, 1994).

E. O. Wilson (1992) refers to this human being's love of nature as *biophilia*. If this natural intellectual phenomenon is not encouraged or has not been given opportunities to flourish during the early years of life, the opposite, *biophobia* may occur (Orr, 1994). *Biophobia* may also manifest in the tendency to regard nature "objectively" as nothing more than "resources" to be used ( e.g., trees for building human's houses); typical industrial community's culture of intellectual activity. Not responding properly to young children's intellectual culture or to their unique way of knowing and constructing knowledge, and pushing them early to adult abstractions about the natural world may lead to *biophobia* at the expense of *biophilia*:

> "If by some fairly young age, however, nature has not been experienced as a friendly place of adventure and excitement, *biophilia* will not take hold as it might have. An opportunity will have passed, and thereafter perception and imagination" (Orr, 1994, p.143).

**Ecological Human Brain and Biophilia vs. Biophobia**

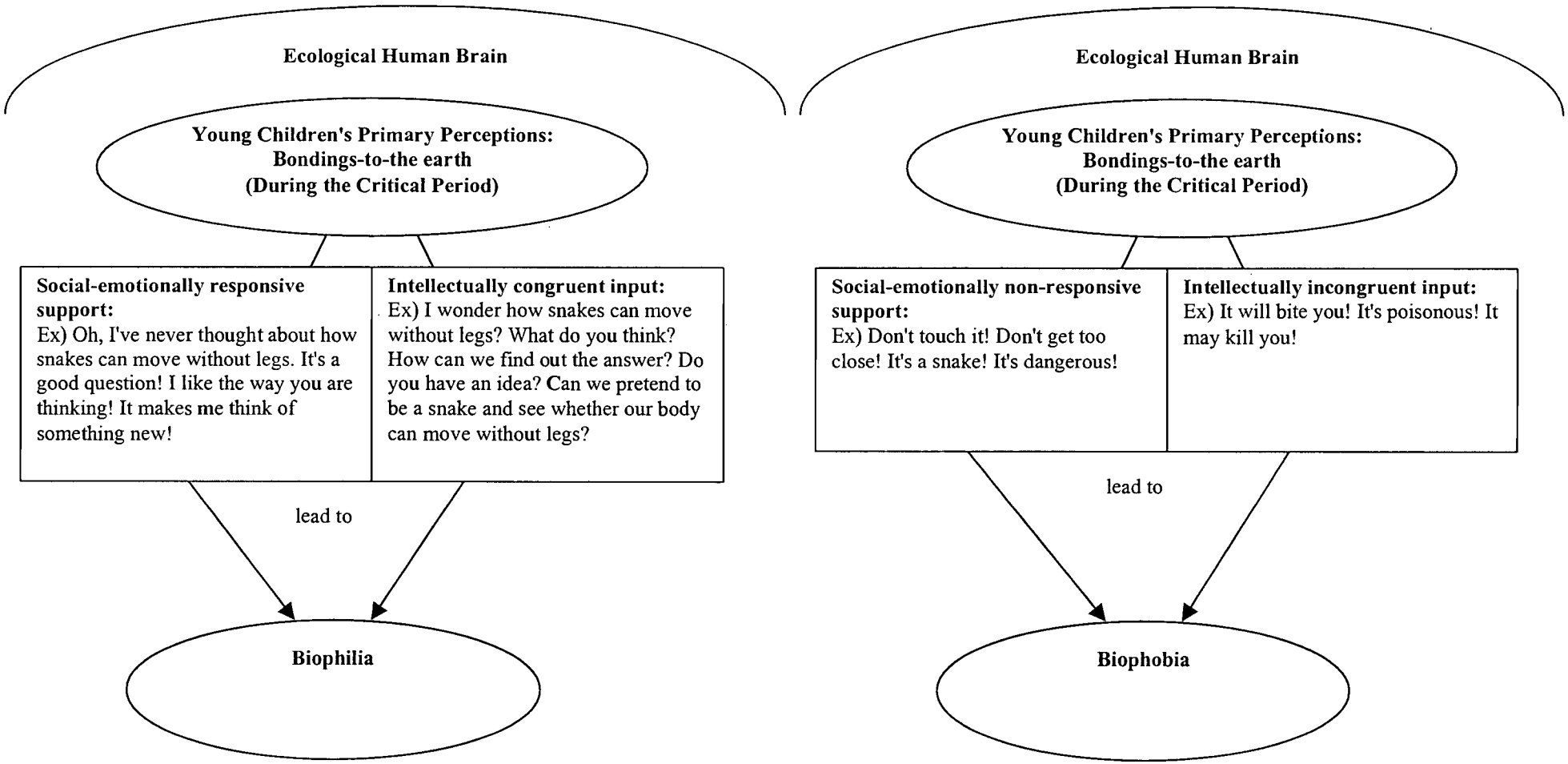
Brain structures are modified by the environment. The environment in which a brain operates determines to a large degree the functioning ability of that brain. The environment affects the way genes work, and genes determine the way the environment is interpreted. (Diamond & Hopson, 1998; Wolfe & Brandt,1998). From the human brain research perspective, the human brain changes physiologically as a result of experiences. B. Shore (1996) discusses this phenomenon as an evolution that has equipped the human species with an "ecological brain," dependent throughout its life on social-cultural environmental input. The brain constantly changes its structure and function in response to external experiences--plasticity[4]. Figure 2 briefly

illustrates the ecological human brain that may lead to either *biophilia* or *biophobia,* dependent on how adults respond to young children's nature given wondrous mind.

As the brain develops in the early years of life, there are periods when children can meet new developmental challenges most easily and efficiently. At the same biological dynamic, primary perceptions as "bondings-to-the earth," are developmental in that they tend to disappear if there is no social-emotionally responsive or intellectually congruent input during early childhood period[5] (Gunnar, 1996; Pearce, 1977). The cerebral cortex in the human brain, which controls higher mental functions such as thinking, planning, remembering, and analyzing, increases in size when exposed to stimulating conditions that are social-emotionally responsive and intellectually congruent. The longer the exposure, the more they grow. If we do not interact congruently with young children's intellectual culture of nature, *biophobia* may profoundly expand in young children's ecological brain. If we interact congruently and responsively with young children's sensory-motor based intellectual interests of the nature, *biophilia* will grow in expanding and holding the naturalist intelligence.

Timing is crucial. Young children's primary perceptions are so called "developmental" in that they tend to disappear (Pearce, 1977; Shore, 1997). The cerebral cortex is vulnerable to environmental influence from its earliest stages of development (Shore, 1997). During the period from birth to age 10, the number of synaptic connections continues to rise rapidly, then begins to drop and continues to decline slowly into adult life. It is also described as "critical periods" or "plastic

**Figure 1: Ecological Human Brain & Biophilia vs. Biophobia**



periods", or "sensitive period" (Pearce, 1977; Shore, 1997). Once the prime time has passed, opportunities for forging certain kinds of neural pathways appear to diminish substantially (For example, optimal periods for *biophiliaric* naturalist intelligence will fade away just like optimal period for first or second language development).

Critical periods do not exist for brain development as a whole, but rather for each of the brain's systems. Brain development proceeds in waves, with different parts of the brain becoming active "construction sites" at different times and with different degrees of intensity. Naturalist intelligence is one example that has critical period during early childhood. We all are born with a certain degree of naturalist intelligence for reasons of survival, if the human environment does not provide a social-emotionally enriched and intellectually congruent support during the early childhood period, we may anticipate serious consequences regarding nature preservation which will negatively affect all. Neglecting young children's interests in nature, or hindering their curiosity and limiting their exploration to nature throughout childhood can impair cognitive abilities as well as social-emotional development. This is similar to the result of emotional neglect that predispose an individual to respond with aggression or violence to stressful or frustrating situations (Gunner, 1996).

As Table 2 illustrates, when we accompany adults' *biophobia* attitudes in exploring nature with children, we may teach "feeling of fear" or "keeping distance" toward the nature instead of promoting young children's curiosity and inquiry to learn and care about nature. In that context, children may feel threatened, they downshift their thinking. Downshifted children as well as adults feel helpless; It's very hard for

them to look at possibilities; they don't feel safe to take risks or challenges their ideas (Abbott, 1997; Shore, 1997). Children, learn best if they are immersed in complex experiences that are socio-emotionally and culturally supported and intellectually congruent.

## DCAP Curricular Consideration for Young Children's Culture of Naturalist Intelligence

DCAP base curriculum constitutes social-emotionally and culturally responsive classroom culture, and an intellectually enriched optimal environment. DCAP base curricula are negotiated[6], emergent[7], and teachable moment-oriented curriculum[8], which are based on individual children's development path, social-emotional needs, social-cultural roots and interests, and their diverse intellectual curiosities (Hyun & Marshall, in-progress).

The curriculum that respond to, validates, and reinforces children's naturalist intelligence and their ways of constructing knowledge of nature is one of the critical parts of DCAP. It will foster the child's life-long love of natural world. If the curriculum fails in that regard, we could be contributing to the increasingly complex culture of environmental crisis, which is considered to be due, in large part, to a growing psychological detachment from and prejudice against nature (Cohen, 1984; Devall, 1984/1985; Raglon, 1993). Neglecting a child's naturalist intelligence and their way of knowing may break up the vital unity of self and world (Pearce, 1977).

DCAP base curriculum that would promote young children's naturalist intelligence is an exploratory curriculum. Table 3 conceptually describes the highlights of exploratory curriculum vs. closed curriculum.

**Table 3. Exploratory Curriculum vs. Closed Curriculum**

| Exploratory Curriculum | Closed Curriculum (Non-Exploratory) |
|---|---|
| • Inquiry-based dialogue maintains congruency of the child's intellectual activity | • Teacher-directed dialogue maintains predetermined intellectual activity |
| • Situated learning occurs with the child's perceptions that are bondings-to-the earth | • Situated learning is presented with the teachers' prepared expectations |
| • Children's multiple perspectives are shared | • Teacher's single perspective prevails |
| • Children are active initiators and participants in investigating their own inquiries | • The child is a passive listener in the teachers' premeditated inquiry |
| • Teachers continuously exercise teachable-moment oriented, negotiated, and emergent curricular notions | • Teachers maintain the prescribed and teacher-expected curriculum |

Compared to the closed curriculum, the exploratory curriculum includes the teacher as a member of the constructive learning community who values and responds to the multiple voices from the individual child. Using children's diverse voices is the driving force for the exploratory curriculum. Shared power for decision-making, rather than an

ultimate single power, pervasively exists as the culture of the exploratory learning community. An exploratory curriculum includes the following characteristics.

- Exploratory curriculum is *inquiry-based.* Inquiry-based curriculum promotes brain-based teaching practices (Pool, 1997). Teachers who focus on inquiry-based dialogue celebrate children's naturalistic curiosity and questions (See, for example, Intellectually congruent input in Figure 1). The human brain is essentially curious, and must be to survive. The brain constantly seeks connections between the new and the known. Learning is a process of active construction by the learner. An exploratory curriculum and the enriched environment give children the opportunity to discover and relate what they are learning to what they already know.
- Exploratory curriculum *promotes constructivist social learning theory.* The brain is innately social and collaborative. Although intellectual processing takes place in children's individual brains, their learning is enhanced when the environment provides them with the opportunity to discuss their thinking with others and to produce collaborative work.
- Exploratory curriculum *integrates human emotion into the learning process.* Learning is strongly influenced by emotion (Goleman, 1995; Greenspan, 1997 & 1992). Emotion plays a dual role in human learning. First, it plays a positive role--the stronger the emotion connected with an experience, the stronger the memory of that experience. Second, when we are able to add emotional input into learning experiences to make them more meaningful and exciting, the brain deems the information more important and retention is increased. Being responsive to children's naturalistic intellectual activity combined with their emotional expression is a vital piece in children's learning of nature (See, for example, social-emotionally responsive/non-responsive support in Figure 1).
- Exploratory curriculum *celebrates and promotes children's wonder, curiosity, and inquiries, but is often disorderly and unpredictable.* The process of learning is wondrously spectacular and at the same times disorderly and unpredictable. Exploratory curricular methods may fit neither easily or neatly within a typical early childhood classroom-based curriculum.

Curriculum components that support exploratory experiences and the naturalist intelligence in young children include:

- responding to a child's *sense of wonder, curiosity, and imagination* in intellectually congruent modes
- sharing the *joy of exploration and first-hand investigations*
- practicing care *of the Earth and the belongings*
- expressing *love of nature and bonding with nature*
- learning *responsibility of caring for nature*

- practicing *teacher receptiveness and awareness of a child's comments and questions* regarding nature by carefully and openly listening to each child.
- *playing in nature as a daily curriculum component.*

There are several other important components in an exploratory curriculum such as: encouraging safe exploration and play, allowing children to explore relationships between self and nature, and promoting individual children's social sharing of their own nature-based exploratory experiences with other children.

## Conclusion

Based on the orientation of DCAP, this article has presented the importance of understanding cultural difference between young children and adults in their way of knowing nature. Children's naturalist ways of knowing nature and constructing knowledge of it should be recognized, validated and responded to in a congruent way. It should be based on young children's curiosity-centered intellectual culture and it should be reflected in daily exploratory curriculum. In DCAP oriented exploratory curriculum, young children should be given many opportunities to explore and learn about, and thus become familiar with natural world (Cobb, 1977).

DCAP teachers should be aware that children's negative experiences (such as the absence of adults' appropriate stimulation or the absence of adults' direct-related responses toward the children's intellectual interests of nature) are more likely to have serious and sustained effects--such as *biophobia*. The brain needs a congruent suitable feedback system. Effective learning depends on culturally supportive emotional energy. We are driven as much by emotion as by logic that is culturally oriented (Abbott,

1997). Children's effective and autonomous learning of nature occurs when they learn about things that are intellectually, social-emotionally, and social-culturally congruent to them.

This article is an another attempt to emphasize the concept of DCAP, in hope that teachers and practitioners go beyond the limited understanding of "culturally appropriate practice." Most frequently observed limited understanding of culturally appropriate practice is "group-oriented" (e.g., practices for ethnically different, linguistically different, racially different, or physically different children and family). The notion of DCAP is much more than a traditionally defined "multicultural early childhood education" that is based on the "group-orientation." DCAP is a theoretical framework that promotes teachers to ponder about other-possible-best-approaches that would be intellectually and socio-emotionally congruent to ALL individual child's growth for her/his own fullest potential. The framework suggests teachers become multiple/multiethnic perspective-takers in their process of decision making as reflective teacher.

Understanding the intellectual culture (*not intellectual level* typically described by Piagetian researchers) of the differences between adults and young children are one of the important areas in DCAP. Critically examining the phenomenon of the intellectual-culture mismatch and attempts to find a way to make an intellectually congruent learning environment are crucial pieces in DCAP. This kind of issue should also be discussed within early childhood teacher education programs that emphasize teacher preparation for developmentally and culturally appropriate practice.

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## Endnotes:

[1] DCAP: Since 1987, the National Association for the Education of Young Children (NAEYC) has embraced Developmentally Appropriate Practice (DAP) as a pedagogical guideline for Early Childhood Education (Bredekamp. 1987; Bredekamp & Copple, 1997). Over the last decade many early childhood educators have critiqued DAP (Bowman, 1994, 1992; Bredekamp & Rosegrant, 1992; Delpit, 1988, 1995; Derman-Sparks, 1992; Hyun, 1998; Jipson, 1991; Mallory & New, 1994; Spodek & Brown, 1993; Swadener & Miller-March, 1993). DAP, they argue, must pay greater attention to cultural differences and be extended to include culturally appropriate practice. In response to this criticism, several teacher educators (Hyun, 1998; Hyun, 1996; Hyun, 1995; Hyun, & Marshall, 1997; Hyun, & Marshall, 1996; Hyun, Marshall, & Dana, 1995) developed a model which expands DAP called Developmentally and Culturally Appropriate Practice (DCAP).

Teacher preparation for DCAP is a proposal for a much-needed and workable teacher education model to help prospective teachers identify their own cultural and ethnic backgrounds and to understand cultural diversity while helping them learn to be sensitive to the cultural backgrounds and characteristics of the children they will teach. This model intends to help prospective teachers develop multiple/multiethnic perspective-taking abilities and culturally congruent critical pedagogy so that they can incorporate the cultural diversity of the children into their teaching. This approach ultimately aims to make early childhood education truly for all individual--multicultural.

In order to adapt DCAP as a framework for providing early childhood education that is more sensitive to multiple and multiethnic perspectives, teachers and prospective teachers should be familiar with the following components which serve as a foundation for DCAP: (1) Developmentally Appropriate Practice (DAP) (Bredekamp. 1987; Bredekamp & Copple, 1997); (2) the goals of multicultural education and appropriate messages for young children (York, 1991); (3) Anti-Bias Curriculum (Derman-Sparks, 1989), and (4) Culturally Congruent Critical Pedagogy (Hollins, King, & Hayman, 1994; Giroux, 1997; Ladson-Billings, 1992; Nieto, 1992).

Based on these knowledge, teachers are required to reflect on their teaching by critically inquiring whether every child in the classroom has received an equal and culturally congruent teaching and learning experience for their development. The teacher strives to learn about and understand each child's unique family influence that directly affects the child's learning and problem solving skills. Through this process of critical pedagogy, the teacher reflects on how s/he can use the child's unique background as a powerful instructional tool for all the children in the classroom. This kind of fundamental reflective thinking used with the teacher's actual everyday practice is what is meant by developmentally and culturally appropriate practice. Such reflection helps to ensure that teachers consider multiple and diverse viewpoints as well as the long-term social and moral consequences of their decisions. Teaching in this fashion will more likely result in education that is truly multicultural--for all individuals.

[2] In social science, culture is defined as behavior patterns, arts, beliefs, institutions, and all other products of human work and *thought*, especially as expressed in a particular community or period. It is also defined as *intellectual activity* or development of the intellect through people's sense making of experiences (Microsoft Encarta '97 Multimedia Encyclopedia). Culture and human intellect are inseparable and interdependent each other within the specific culture of the individuals encounter. Thus, when we attempt to understand diverse children's ways of knowing and their various forms of intelligences, we should consider their cultural contexts of the intellectual activities formed as well.

[4] Plasticity: Brain ability to change the structure and chemistry in response to the environment.

[5] Young children's primary perceptions are so called "developmental" in that they tend to disappear (Pearce, 1977), as every brain researchers indicate; human brain has a remarkable capacity to change, but timing is crucial (Shore, 1997). Thus, we see more of young children who show a high level of naturalistic intelligence than many of grown-ups.

[6] Negotiated curriculum: Negotiated curriculum is based on the ownership of learning that maintains a continuous, shared power relationship between teachers, learners, and parents. Here, learners and teachers initiate learning expectations within constraints and negotiate lessons and learning experiences. Responsibilities and inevitable divergence leads to growth and change (Hyun & Marshall, work-in-progress).

[7] Emergent curriculum: Emergent curriculum is based on children's situated self-expression. Here, children are the source of the curriculum through child-initiated lessons and interest-base learning experiences. Theme studies and project-based approaches with real-life activities offer relevant learning experiences as well as academic study (Hyun & Marshall, work-in progress).

[8] Teachable moment oriented curriculum: Teachable moment-oriented curriculum is based on the notion of "developmental readiness." Teachers' conventional knowledge of child development guides their observations of a child development and play. As the learner indicates a readiness or interests, the teacher plans a lesson/learning experience and ultimately responds/interacts/intervenes. Teachable moments include typical scope and sequence-oriented developmental curriculum, play-based curriculum, and "autoeducation" curriculum where children teach themselves through their own experience (Hyun & Marshall, work-in-progress).

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